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A SYNTHESIS OF METHODS TO ASSESS THE BIOLOGICAL EFFECTS OF HABITAT ALTERATION IN COASTAL WATERS

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LTG 1 Poster 01

Science Questions

MYP LTG 1: Provide the approaches and methods to develop and apply criteria for habitat alteration that will support designated uses for aquatic systems.

What are the quantitative relationships between aquatic habitat alterations (stressors) and their biological effects on valued fish, shellfish, and wildlife?



How Research Addresses the Water Quality MYP Goals

Our project has developed regional stressor-response models designed to support criteria for habitat alteration and designated uses.

We are now synthesizing our research to recommend the most appropriate national approaches for habitat-based environmental decision-making in support of designated uses.

Research Objectives

Construct habitat alteration-biological response models for valued aquatic populations and communities to support habitat-based water quality criteria and other approaches for environmental protection and restoration.

Research Questions

A number of complex research questions must be addressed to provide rigorous habitat alteration-biological response models for environmental decision-making:

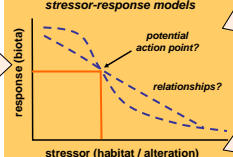
What are the biotic endpoints?

How do we measure them consistently and efficiently?

What expressions of the data best capture biotic response?

Research

Research Outcome: Regionally applied stressor-response models



Research

What natural factors affect the relationships?
 Which ecosystem types can be grouped?
 Over what geographic ranges can the relationships be applied?
 How do we express uncertainty?
 How do we translate continuous relationships into discrete action levels?

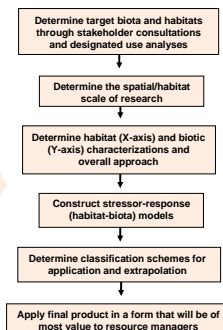
What habitat endpoints are relevant and readily measured?
 How do we characterize the spatial extent and arrangement of multiple habitats?
 What are the appropriate spatial scales?
 Can we establish that the problem is anthropogenic?

Research Methods & Collaboration

Habitat-biota relationships are inherently regional, but collaboration among regional research efforts develops national approaches.

Research in each regional area is designed to answer common research questions in a comparable way based on a shared framework.

Aerial views of two estuarine coves at low tide



Research Results

Fish-habitat relationships in Great Lakes coastal wetlands
 A comprehensive data set showed that a wide gradient in nutrient loading and in habitat/land use parameters across Great Lakes wetlands led to a cascade of water quality and biological responses. Wetland hydrology and biogeography also significantly influenced wetland biota.

Estuarine Habitat and Faunal Associations in the Pacific NW
 English sole
 Coho salmon
 Dungeness crab
 Whole-estuary scale biota-habitat data sets and analyses in the Pacific Northwest showed large (up to 100x) and temporally consistent differences among habitats for ecologically important benthic macrofauna and for nekton community metrics such as number of species, numerical abundance, and total biomass.

Coastal Stream Networks and Juvenile Salmon in the Pacific NW
 Datasets relating populations of juvenile salmonids to stream habitat characteristics showed that juvenile coho are dependent on habitats distributed within the entire stream network of a 67 km² watershed, and that use and importance of habitats in various locations within the network varies with season.

ORD habitat research produces stressor-response models at regional and local scales to develop approaches at national scales.

Geographic Range of Current Projects
 Coastal zones with active ORD habitat research

Predictive Models for Estuaries of the Northern Gulf of Mexico and Southeastern Atlantic
 Stressor-response models are being developed to link habitat alteration and loss to responses of bay scallop populations.
 An EPA report evaluated population structure, habitat dependencies, and economic value of near-shore fisheries in the northern Gulf of Mexico. Stressor-response models are being incorporated in the development of a web-based tool-kit for assessment of habitat value.

Common findings:
 The complexity of defining habitat is a common challenge.
 Classifications for hydrology and geography are required to interpret and extrapolate results.
 Nutrients and land use practices that degrade habitat are pervasive stressors; interactions with other EPA workgroups are addressing this.

Habitat and Winter Flounder Relationships in NE Estuaries
 Datasets relating winter flounder population parameters to sedimentation rates and habitat quality have been used for decision making by state managers.

Scallop population response models
 Stressor-response models are being developed to link habitat alteration and loss to responses of bay scallop populations.

Synthesis of Existing Estuarine Habitat Research
 A comprehensive bibliography and review of published concepts and approaches for habitat research has been assembled and is being continually augmented for all species and habitat types.

* We have organized five national habitat meetings as communications pathways.
 * We have published over 20 peer-reviewed publications, with more in preparation.

Anticipated Conclusions & Future Directions

National approaches and methods to develop criteria for habitat alteration will be developed from NHEERL stressor-response relationships.

Next steps: to apply our data and models to EPA Office of Water's environmental decision-making frameworks, including Tied Aquatic Life Uses (TALU) and the Headwater Streams / Isolated Wetlands Initiative.

Customers and Interactions

We are producing deliverables for:

- EPA Clients:
 - Office of Water under the Tied Aquatic Life Use framework and the Headwater Streams / Isolated Wetlands Initiative
 - Office of Water National Estuary Program (NEP)
 - Tillamook Bay NEP
 - Mobile Bay NEP
 - Galveston Bay NEP
 - Pearl River Bay NEP
 - Great Lakes National Program Office
 - EPA Regions 1, 2, 4, 5, 6, and 10.
- Other Federal Agencies: NOAA, USGS, USDA
- Numerous States: AL, CT, FL, LA, MA, MI, MN, MS, NY, OH, OR, RI, TX, WA, WS
- Several counties, municipalities, parishes, and tribal authorities around the nation

How Research Contributes to Outcomes

This research will provide a practical, scientifically-sound tool kit which our customers can use to help protect and restore coastal habitats and their associated living resources.